Dimensions of the type :—

Head and body 353 mm.; tail 65; hind foot 74; ear 70.

Skull: greatest length 73·5; basilar length 55; greatest breadth 36; nasals, length diagonally 33, breadth 17; intertemporal breadth 13·7; breadth of palatal bridge 5·5; diastema 19·5; palatal foramina 18 × 8·5.

Hab. Nha-tiang, Annam. Sea-level.

Type. Adult female. Original number 16. Collected 25th December, 1905, and presented by Dr. J. Vassal.

This very interesting little hare, which I have much pleasure in naming after its discoverer, is widely different from any of the Burmese and Siamese species, and is only related to that of Hainan, from which it differs by its conspicuously paler colour.

LIX.—*Spinning Slugs and Snails.* By L. Lindinger *.

In observing land- and water-mollusks I was struck by a faculty apparently widely spread among these animals, which appears to be known to but few malacologists, namely the power of drawing out threads of mucus which harden, and by means of which the creatures are able to let themselves down from firm objects.

I could find but few statements in literature. Almost all notices mention slugs of the genus *Limax* (and *Agriolimax*). Thus Schilling ('Grundriss der Naturgeschichte') states with regard to *Agriolimax agrestis* :—"From the slime on the surface of the body it forms threads, by which it is able to let itself down from the branches to the ground." Geyer ('Unsere Land- und Süsswasser-Mollusken,' 1896, p. 13) is acquainted with the same fact in the case of *Limax arborum*. Precise statements as to the nature of the spinning and as to experimental observations on the length of the thread in the case of *Agriolimax agrestis* are given by M. Ballerstedt in the 'Naturwissenschaftliche Wochenschrift' (Neue Folge, i. pp. 463–465). This author isolated the subjects of his experiment upon a leaf, which was attached to a thread. The leaf was then exposed to the sun, which caused the animals to change their temporary sojourning place; they did not, however, crawl up the thread supporting the leaf, but descended from the latter by means of their mucus which

* Translated by E. E. Austen from the 'Zoologischer Anzeiger,' xxix. Bd., No. 19 (29th December, 1905), pp. 605–610.

hardened into a thread. One thread measured 147 cm., and for the attainment of this length over half an hour was required. In connexion with the phenomenon in question allusion is made to yet another habit of the animals, namely that of, when passing from one elevation to another, as, for instance, from leaf to leaf, securing themselves by means of a bridge of mucus, which binds the foot to the support just left until firm hold has been taken of the new one.

In one case the same observer saw the slug crawl back on the thread that had been formed, during which procedure the thread was, as Ballerstedt expresses it, sucked up again by the slug's mucous membrane. Further contributions on the subject are to be found in the 'Gartenwelt' (vol. vii. 1903, p. 346) *, where the phenomenon of the slug crawling back on the thread is likewise noticed. The thread-drawing in the case of *Limax* is also referred to by Leydig ('Horæ Zoologicæ,' 1902, p. 90), who at the same time mentions the names of two earlier observers, Lister and Latham.

Yet it is not only among the land-gastropods that this singular faculty has been shown to exist; there are also statements concerning water-mollusks. In the 'Naturwissenschaftliche Wochenschrift' (Neue Folge, i. 1902, pp. 509 *et seq.*) W. Brenner writes that in the case of water-snails, especially *Limnæa vulgaris* [= *Limnæa stagnalis*, var. *vulgaris*], he has observed how the animals regulated their ascent and descent through open water by means of a thread of mucus attached to a point of support. An interesting note was published by E. Pohl in 'Nerthus' (2. Jahrg. 1900, pp. 738 *et seq.*). It has long been known that *Aplexa hypnorum* suddenly bobs up on the surface of the water and disappears again equally quickly. Since Pohl appears to have found out the explanation of this peculiar behaviour, I should like to give his statement in his own words. He writes:—

"The snails (*Physa* [*Aplexa*] *hypnorum*) had so greatly increased in number, that they often hung in regular clusters on the grated meat which had been thrown in. I then noticed how individual snails separated from a cluster and glided to the surface, in some cases straight upwards, in others in an oblique direction, but always in a straight line, as if upon some firm object although in the middle of the water. The animals also return by the same route, meet, and pass close by one another. It was only after long and close observation that I discovered a number of extremely fine threads, that, starting from the lump of meat, led to the

* For this reference I am indebted to Dr. C. Brick, of Hamburg.

surface of the water and so rendered the tight-rope-walking performance possible. The snails remained at the surface only long enough to thrust the respiratory orifice for a few seconds out of the water, and then sailed back to their meal again as quickly as possible. The small specimens of *Planorbis* in the same vessel never make use of the tight-rope, but crawl up the glass or let themselves float up in the water without any attachment. Since I have never read that *Physa* possesses the power of spinning threads, I thought it advisable to mention the fact here. It is not possible for the threads to be due to other creatures, such as perhaps the water-spider, since there have never been any in the vessel."

In 1904 I myself mentioned the names of a number of slugs and snails that possess the power of drawing threads *. Apart from *Agriolimax agrestis* and *Limax arborum*, which are mentioned elsewhere in literature, these are among land-mollusks *Agriolimax lævis*, and among water-snails *Ancylus fluviatilis*, *Aplexa hypnorum*, *Bythinia tentaculata*, *Physa fontinalis*, and a species determined by me as *Physa acuta* †.

To-day I am able to add to the list *Limax variegatus*, *Amphipeplea glutinosa*, *Planorbis carinatus*, *P. complanatus*, *P. nitidus*, and *P. umbilicatus*.

As regards the thread-spinning in the case of the species of *Agriolimax* and *Limax*, I cannot add much that is new to Ballerstedt's description. While it is but seldom that this kind of locomotion, which at first sight seems somewhat strange as exhibited by slugs, can be witnessed in the open—for which the observer rather than the slugs is responsible—it can be produced experimentally at any time. In order to obtain a successful result it is necessary that too great a distance should not at first be interposed between the animal and the point that it has to reach. An interval of about 15 cm. is sufficient. Once it has formed a piece of thread, the distance is generally immaterial. For the actual experiment the animal is placed upon a portion of a leaf suspended by a fine thread.

Crawling back on the thread already drawn out is also not uncommon, with the reservation, however, that well-

* "Verzeichnis der in und um Erlangen beobachteten Mollusken," Abh. Naturhist. Ges. Nürnberg, Bd. xv. 2. Heft, p. 68.

† As Herr D. Geyer, of Stuttgart, informed me, this is probably not *Physa acuta*, but a similar species introduced from North America. The same remark very likely also applies to the species recorded as *Physa acuta* by O. Goldfuss ('Die Binnenmollusken Mitteldeutschlands,' 1900, p. 28) for Leipzig, and by H. Sell (Nachrichtsbl. deutsch. mal. Ges. Bd. xxxvii. 1905, p. 40) for Copenhagen.

nourished individuals containing much moisture only adopt this course when one has made the distance from the ground too great, or when light is thrown on them from below, while animals less favourably equipped in these respects make the return journey relatively often.

The way in which the animals behave upon an isolated leaf, which is brilliantly lighted or warmed from above, or upon which a strong current of air is suddenly directed, shows us that they are not very unaccustomed to the route through the air; if the expression "deliberation" be employed with the necessary limitation, it is here apropos. At least it may be said that letting themselves down upon a thread of mucus is to be numbered among the normal faculties of the animals.

The circumstance that the animals do not try to escape upwards on the thread by which the leaf which serves as an experimental table is supported, is simply due to the fact that the influence which disturbs the animals makes itself felt from above. When I applied the source of light and warmth (in the form of an electric incandescent bulb) to the under side of the leaf, I succeeded in several instances in causing the slugs to take to flight in an upward direction. It is true that, when they come too near to the lamp, the animals for the most part simply let themselves drop.

Under normal conditions also the land-snails seek their hiding-place in a downward direction, when light or warmth becomes too troublesome to them.

The hardened thread of mucus that has become useless on the crawling back of the animal is not, as Ballerstedt supposes, sucked up again by the slug's mucous membrane, but is thrust to the hinder end of the foot owing to the movements of the latter; here it is stuck together by the freshly excreted slime, and is subsequently left behind when the animal has again reached a firm support.

In the case of the water-snails two forms of thread-drawing can be distinguished, since the water enables the animals to ascend as well as to let themselves down. While the animals when descending in jerks twist hither and thither like the slugs and turn round on their axis, in consequence of which the thread (under the microscope) appears spirally twisted, climbing up almost always takes place quietly. In descending the animal has the sole of the foot turned downwards longitudinally so as to form a kind of groove, and slightly arched from front to rear, so that the head occupies an almost horizontal position. Climbing up takes place more continuously and somewhat slowly. The thread may attain

a passable length even in climbing up; in the case of *Amphipeplea* I measured one that was 20 cm. long.

Apart from the crawling back that occasionally takes place, the same thread is never used more than once; whether, as might be supposed from Pohl's description, *Aplexa hypnorum* behaves differently has yet to be ascertained. The rapidity of its progress is at any rate remarkable. It is true that *Aplexa*, like its near relation *Physa*, is distinguished by its very active movements.

Let us now turn to the fact of the thread-spinning itself. This cannot excite surprise when we reflect that all mollusks secrete a viscid mucus, which always adheres to the support and is continuously replaced. Anyone who thoughtfully observes a snail crawling away on sandy or dusty ground must notice how clean the animal keeps, although the sticky surface leads us to suppose the opposite (it is not always easy to remove snail slime from the fingers). Every collector knows the tracks, that cover depressions with a glistening pellicle; every possessor of an aquarium, who keeps specimens of *Limnæa*, must have been vexed at finding that the animals, in so far as they do not eat them, regularly glue up some plants (such as *Myriophyllum*), so that their shoots look like the brush out of the gum-pot when it has become dry. Upon this cleansing process of snails and slugs depends the well-known method of killing the animals by means of a repeated distribution of salts or ashes. In consequence of the copious excretion of mucus which is necessary again and again in order to remove the unwelcome and probably also corrosive covering, the animals become so much weakened that they perish *.

It follows that even the bridge of mucus, alluded to by Ballerstedt, does not occasion surprise. As regards Ballerstedt's assumption that thereby the animals guard themselves from slipping off, before the foot has taken firm hold of the new support, we may entertain two opinions. When the snail passes over a gap in the substratum, the slimy track is bound to form a bridge. It is self-evident that the latter also safeguards the animal in a manner that is not to be underrated; its formation is, however, in all likelihood not effected by the animal for this special case, but is the result of the viscid character of the mucus.

In the progression, too, of mollusks the mucus at all events

* Further details as to slugs' slime will be found in Künkel's paper, "Die Wasseraufnahme bei Nacktschnecken" (Zool. Anzeiger, Bd. xxii. 1899, pp. 388–396 and 401–404).

plays such a part that it might be asserted that the animals crawl upon their slime. Let us imagine a *Limax* or an *Arion* that possessed no mucus. Every grain of sand, every pine-needle, every dry fragment of a plant upon the ground would to a certain extent give way, and progression, though not exactly impossible, would be greatly impeded. The mucus in the first place cements everything together into a relatively firm whole. In the case of the mussels also it serves a similar purpose.

If we imagine the bridge of mucus extended, we have the rope of slime that young Helicidæ and the species of the genera *Hyalina* and *Vitrina* are capable of forming. In the case of these creatures, if their weight is not too great, the mucus is tough enough to be drawn out into short threads which support the animal, though they are certainly considerably thicker than in the case of *Limax*. In the case of *Vitrina pellucida* I measured threads of from 15 to 20 mm. in length; in that of young specimens of *Arion* the thread gave way on reaching a length of 5 mm., and older individuals fell before the foot had completely left the support.

It follows that from *Vitrina* to *Limax* we see an advance in the process of thread-formation. In order to be capable of being drawn out into durable threads, the mucus must be extremely tough and harden quickly. In the case of *Agriolimax* and *Limax* it possesses these properties in a high degree. Now since various authors (Leydig, Simroth, Clessin, and Goldfuss) state with regard to *Amalia* that the mucus is excessively tough, and that byssus-like threads occur in it, it may be expected that the animals of the genus in question possess the capacity of thread-drawing in a much higher degree than those of other genera. Simroth (*apud* Clessin, 'Mollusken-Fauna von Oesterreich-Ungarn und der Schweiz,' 1887, p. 54) writes as follows concerning the mucus of *Amalia robici*:—"If it is proved by Leydig that the mucus of the species of *Amalia* owes its varnish-like viscosity to byssus-like threads, we here have actual byssus. Widely scattered on the body, closer together on the sole of the foot, but especially in the groove which bounds the locomotor median area, there projects a series of whitish pointed threads, which are approximately equal to this median area in length."

In conclusion, I would point out that gardeners should take a special, although certainly not a benevolent, interest in the spinning slugs. Undeniably the best method of protecting valuable plants from being eaten by slugs and snails is to render it impossible for the animals to obtain access to them by placing the plants in saucers filled with water. But this

otherwise excellent plan, which in the case of orchids, *Sarracenia, Nepenthes, Drosera,* &c., is moreover beneficial to the growth of the plants, is almost valueless as against the species of *Limax* and *Agriolimax,* which are also to be met with in glass-houses, since these slugs can also reach the plants through the air. In this case the best defence will still be found in diligently searching for and collecting the animals, which must be done principally in the evening and early in the morning.

BIBLIOGRAPHICAL NOTICE.

Catalogue of the Collection of Birds' Eggs in the British Museum (Natural History). Vol. IV. London: Printed by Order of the Trustees of the British Museum. 1905.

This volume, by Mr. Eugene W. Oates and Capt. Savile G. Reid, deals with the eggs of the Families from the Timeliidæ to the Certhiidæ, and includes descriptions of some 620 species.

A feature of the book, as in the preceding volumes, is the great beauty of the plates. The selection of specimens illustrating the great range of variation which some species exhibit is a step in the right direction, but we venture to think the usefulness of the Catalogue would be immensely increased if a summary of the characteristic features of the eggs of each family were given, as well as a short account of the structural characters of the shell.

Again, it would have been helpful had special reference been made to the eggs of such species as are supposed to be peculiar to Great Britain, but represented on the Continent by scarcely distinguishable forms. In the case of the Long-tailed Tit (*Ægithalus roseus*), for example, we find on comparison of the descriptions of the eggs of this bird and those of the Continental *Æ. caudatus* that they are distinguishable, while this is not the case with the eggs of our Coal-Titmouse (*Periparus britannicus*) and the Continental *P. ater.* Finally, whenever possible, the number of eggs in a clutch should be definitely stated, yet this appears in no single instance to have been done.

MISCELLANEOUS.

The Echinoderm Name Calveria hystrix.

To the Editors of the 'Annals and Magazine of Natural History.'

Gentlemen,—In laboriously proving the identity of *Korethraster hispidus* with *Calveria hystrix* (Ann. & Mag. Nat. Hist., Feb. 1906, p. 251) I was unconsciously treading in the footprints of a master. This identity was, without comment, assumed by Lovén in a footnote on p. 31 of his 'Études sur les Échinoïdées' (1875).

Yours, with apologies,

F. A. Bather.

British Museum (Nat. Hist.),
24th Feb., 1906.